THE ELECTRICAL WORLD

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The Gillett Long Distance Telephonic Apparatus.

In the few years that have marked its growth the art of telephony has already fulfilled most extrordinary promises and realized most wonderful possibilities, and it may justly be ranked, even now, among the most valuable of the arts with which electricity has endowed our civilization thus far. Yet it is far from having exhausted its resources and reached the limit of its development. There is a new and almost boundless sphere of usefulness into which it had scarcely thought of entering before now, and where it is destined to play a rôle of the highest importance—the transmission of articulate speech to long distances. Before its task is completed the telephone must yet fulfill this promise—it must conquer distance. The now indispensable conveniences and facilities which it places at our command for intercommunication between different parts of cities and neighboring towns, must also be made available between cities and towns widely distant from each other. It is, indeed, to this new development, this wider extension of the art that the public is now looking forward with the most interest.

Long distance telephony has been the dream of both scientist and inventor ever since Bell inaugurated the art by demonstrating the possibility of the electrical transmission of speech. But it is only within a comparatively short time that we have begun to approach the realization of this dream. The art of telephony, like all others, "had to creep before it could walk." When the telephone left the hands of Bell its voice was too weak even for ordinary distances. In order to "cultivate" and strengthen it a certain process of evolution and improvement under the fostering care of the inventor was needed. The microphone transmitter had to be invented, the induction coil and other important accessory devices had to be brought into requisition. It was only after the telephone had succeeded in attaining its natural growth by assimilating these necessary elements that the higher development tending to make its voice reach "o'er hill and dale" began. At first it was the successive improvements made in the transmitters and receivers intended for ordinary use that enabled the distance of transmission to be gradually increased. But the practical limit to this increase is reached usually within a few hundred miles, with these forms of apparatus. This has since led some inventors to experiment with modified forms of apparatus specially constructed for the purpose of transmitting speech to long distances.

Mr. Webster Gillett, of Ypsilanti, Mich., appears to have been particularly successful in this line of invention. His "long distance" apparatus, the various types of which we take occasion to illustrate herewith, presents features of considerable novelty. The special interest which attaches to this apparatus, from the very fact that it is designed for long distance transmission, is greatly enhanced by the flattering success obtained with it in numerous long distance tests lately made over the wires of the Postal Telegraph Company. Mr. Gillett has been interested in the development of telephony almost from the very first, having obtained patents for improvements as early as 1878. Of late years it may be said that he has made a "specialty" of long distance, for all his efforts have been concentrated on the task of perfecting his apparatus, so as to make it powerful as well as sensitive.

The most important problem to be solved at the outset was to provide a suitable microphone contact, for, as we know, the clearness, the distinctness, the loudness, even, of the articulation, depend greatly upon the manner in which this contact performs its function. In ordinary microphone transmitters all the sound vibrations which make the diaphragm vibrate cause the carbon or metallic pieces between which this delicate contact exists, to move relatively to each other so as to make the contact alternately looser and closer. The resistance to the passage of current through this contact diminishes considerably a the pieces are pressed more closely together; but it increases greatly, on the other hand, when they move away. The difference may amount to several ohms. It results, therefore, that at each sound vibration, the resistance of the local circuit, through this contact and including a battery, and the primary coil of a transmitter, is increased and diminished, thus causing a fluctuation in the current. These fluctuations or "undulations" react upon the secondary wire of the induction coil, and give rise to impulses of current of higher electromotive force that are transmitted over the line. For the perfect transmission of speech each one of these impulses must act individually on the receiver at the other end, and for this they must be well defined.

The problem of long-distance telephony consists precisely in giving to these impulses a sufficiently abrupt, sharply defined character, for they are expected to withstand a certain amount of retardation in transmission that tends to

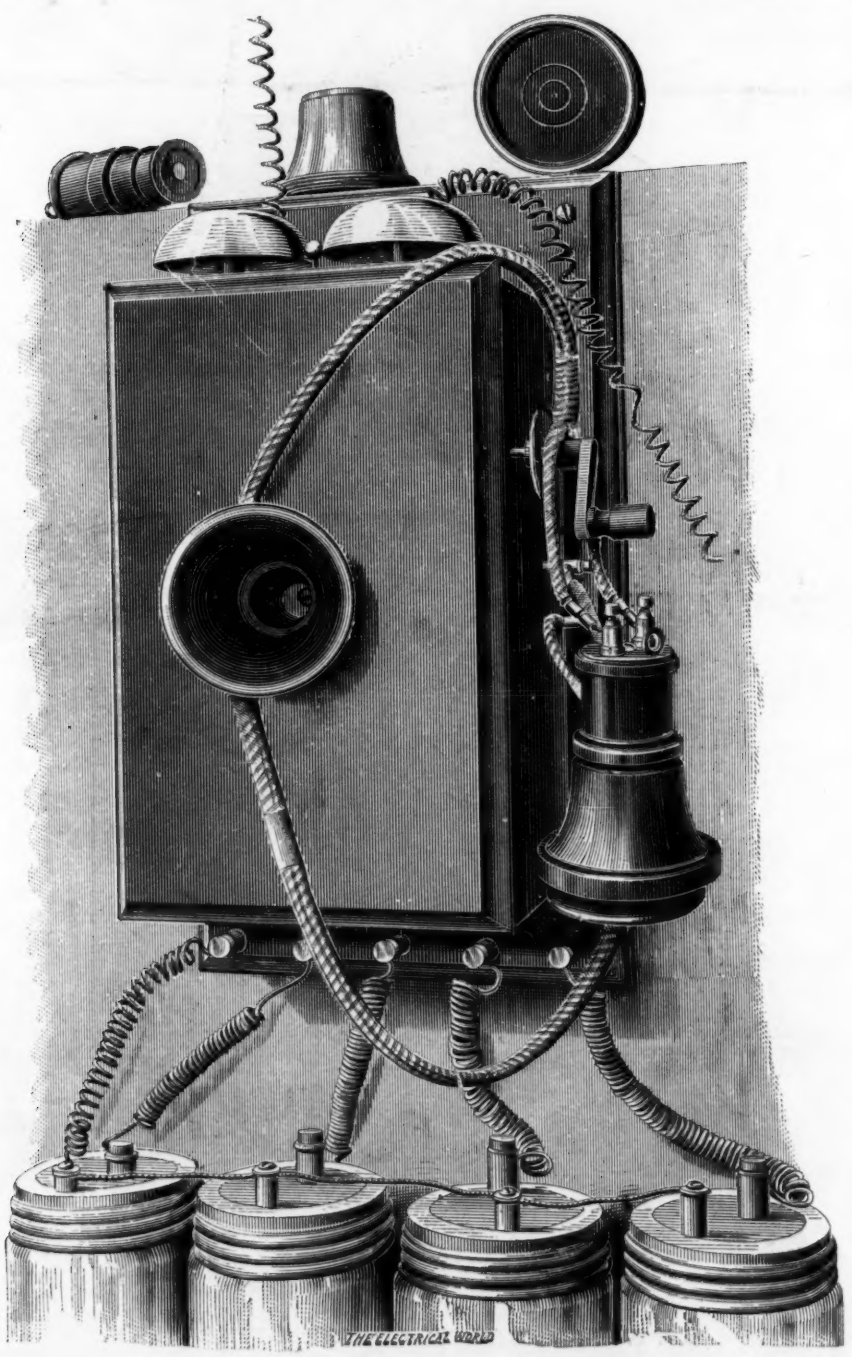

FIG. 1. THE FOUR-POINT TRANSMITTER—CLOSED.

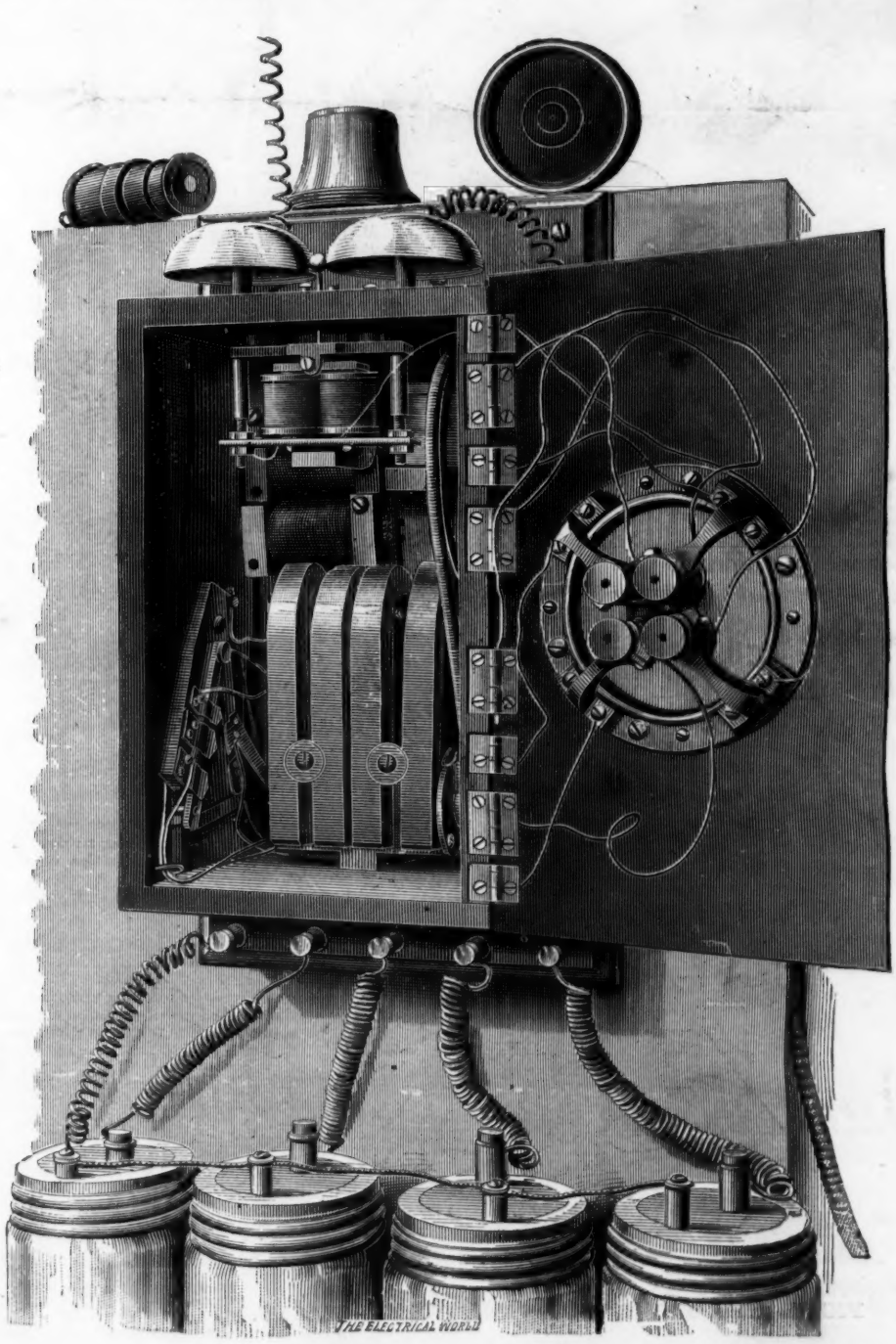

FIG. 2. THE FOUR-POINT TRANSMITTER—OPEN.

merge or prolong them into each other until they lose their individuality. But as these secondary impulses are but reproductions "on a higher scale" of the primary ones it is plain that much depends on the microphonic contact. These primary impulses must themselves be made more abrupt and sharply defined, and for this the contact must be so constituted as to cause a greater variation of resistance. This can be accomplished in a certain measure in contacts such as those used in ordinary transmitters by adjusting the points so they may bear more lightly against each other. But in so doing a difficulty arises, for the contact is then likely to be influenced by other movements than the vibrations of the voice transmitted, as, for instance, the impact of the air expelled from the mouth in speaking, the vibrations of the building, etc. These occasion a crackling, rattling sound that would greatly interfere with the transmission over long lines, in which frying noises from induction and other sources already exist.

To avoid these difficulties Mr. Gillett has devised a new and original form of contact, and in order to improve the results still further he has multiplied these contacts and grouped them in a peculiar way so that they may strengthen but especially "correct" each other. Each contact consists of a metallic needle attached to the diaphragm of the transmitter and moving with it, its free end passing

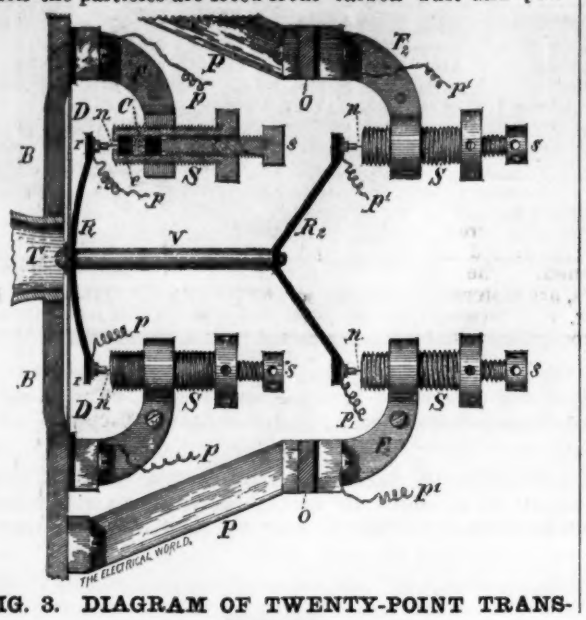

FIG. 3. DIAGRAM OF TWENTY-POINT TRANSMITTER.

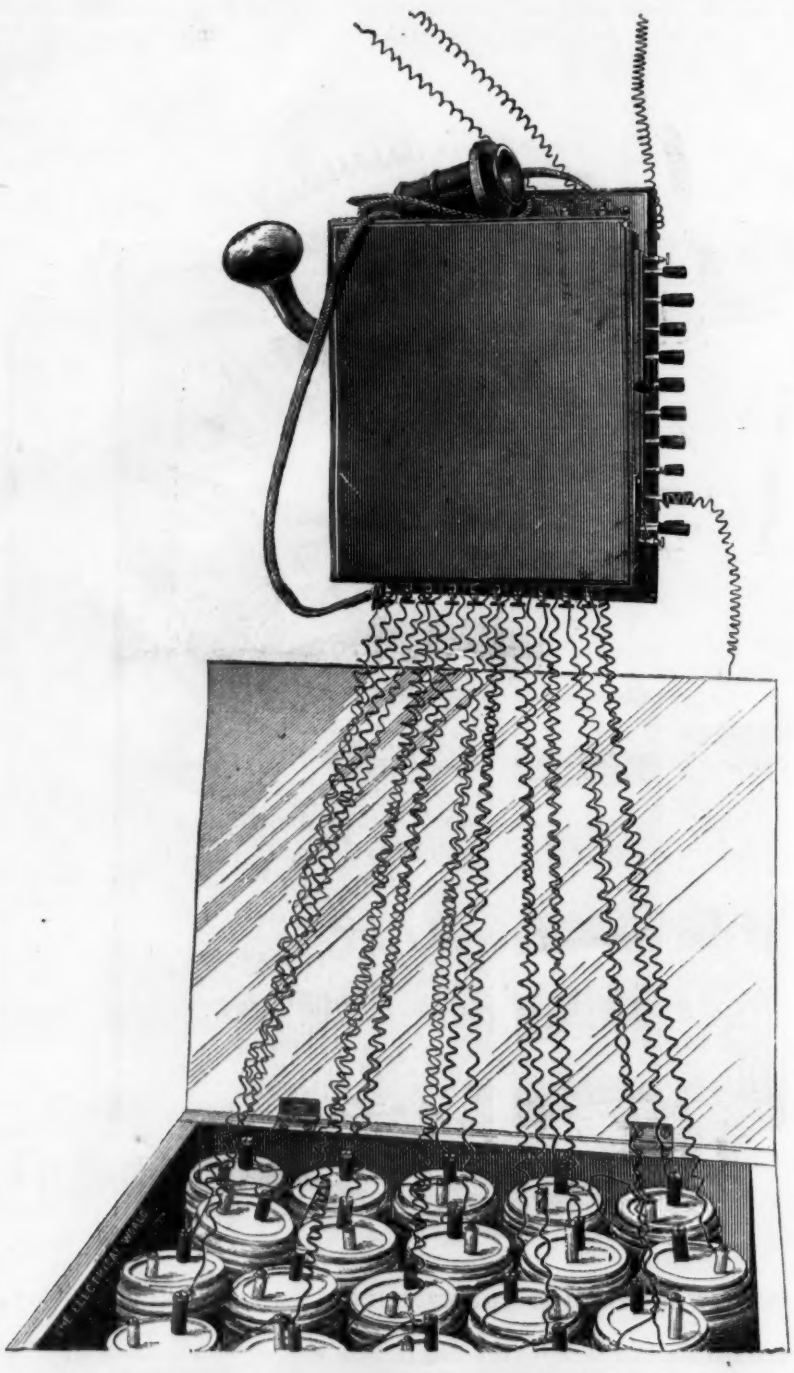

FIG. 4. THE TEN-POINT TRANSMITTER—CLOSED.

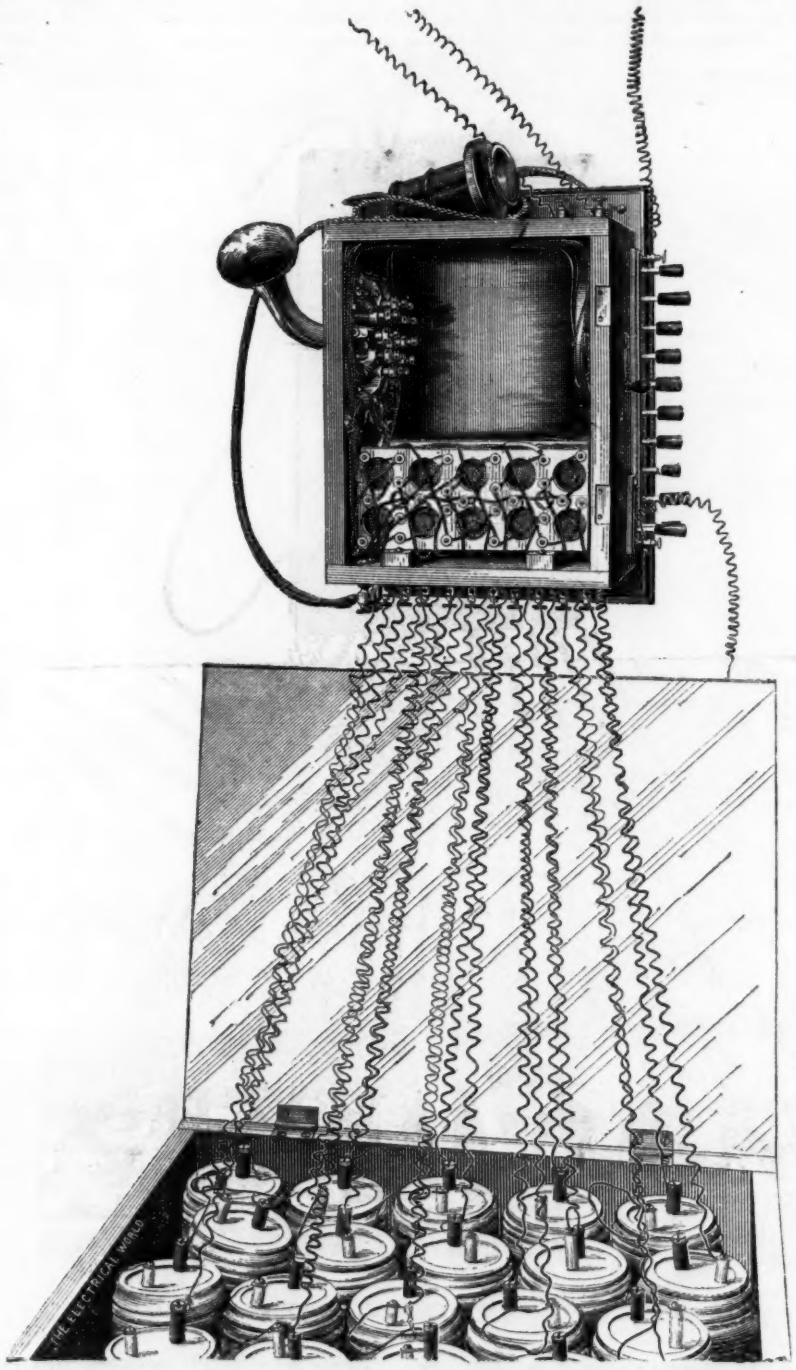

FIG. 5. THE TEN-POINT TRANSMITTER—OPEN.

through an opening into a small recess where it penetrates slightly into a mass of carbon grains, or particles that are more or less compactly held together *under compression* between elastic cushions. In a contact of this construction there are doubtless several actions that conspire to accomplish the object desired—large variations of resistance. In addition to the variations of contact pressure produced at the point of the needle, it is not improbable that a certain amount of pressure is transmitted to the carbon particles, and also that a certain degree of molecular vibra tion must result in these particles themselves. It is quite certain that the microphonic action is not produced merely at the end of the needle, but that it involves the aggregation of carbon particles as well, for Mr. Gillett has found a special advantage in using these particles instead of fine powder. His experiments have led him to give a preference to rough-hewn granules that are covered with excrescences like crushed ore, and he prepares them especially for this purpose from retort carbon. He subjects the carbon to a kind of stamping or crushing process in a mortar, after which the "grist" is sifted through a fine sieve having sixty meshes to the inch. By this operation the particles are freed from carbon dust and powder. They are now sifted through a thirty-mesh sieve and the particles which are small enough to go through are those used in the transmitter contacts. When examined with the microscope these particles seem like so many craggy boulders full of rough and sharp edges. These projections when delicately compressed against each other must necessarily form sensitive microphone contacts.

Mr. Gillett has constructed several transmitters having only one of these contacts, and he has used them with success over much greater distances than the ordinary single-point transmitters can compass. But for longer distances his design contemplates the multiplication of the contact-points. He has constructed long-distance transmitters having four points, others having ten points, and, finally, he has lately completed one with twenty points of contact. The manner of grouping the contacts deserves special attention. Thus far, in transmitters containing several contact points, the current was either divided equally through the points, which were connected in multiple manner, or else it was passed successively through them, in series. Mr. Gillett, however, proceeds differently. He has found it to be a great advantage to let each contact-point do its work individually, independently of its colleagues, and to give it its own circuit, its own source of current. He does this by using a separate induction-coil for each contact-point. He then connects the secondary wires of these induction-coils together, not in series, as one would expect, but in multiple or divided circuit. In this case the electromotive force of the induced current impulses sent over the line remains equal to that which one induction-coil alone would produce. So that in this respect there is no gain realized.

But on the other hand this "multiple" secondary coil, as it might be termed, adds much less resistance to the line, for each branch practically increases the total area of section. Thus with the ten point instrument, the resistance of each secondary coil being 175 ohms, the resultant resistance is only 17.5 ohms. If it were desired to increase the electromotive force, the length of wire in each could be doubled, and even then the total resistance would be only 35 ohms. Strange to say, however, Mr. Gillett has not yet found his "supply" of electromotive force deficient, even though these secondary coils are not materially different from those used with the Blake transmitters. The coils which he uses are about 4¾ inches long and 1¼ inches in diameter, the primary coil being of No. 20 (B. & S.) wire wound to about 4 ohms and the secondary of No. 36 wire wound, as just stated, to about 175 ohms. These coils as used with the contact points of Mr. Gillett no doubt produce impulses of much higher electromotive force than they would otherwise, for much depends, as is well known, on the range of fluctuation produced in the primary coils.

The great advantage which Mr. Gillett has realized, however, by connecting his secondary coils in this ma nner, is that the impulses are rendered more distinct and defined, by a process of mutual correction and "trimming." It is not improbable that in such multiple instruments some of the contact points begin to act a little sooner—it might be even but the ten thousandth part of a second—than the rest, and it is equally probable that some cease to act after the rest. Now with the secondaries connected in series the impulse sent over the line would begin with the first to act and would end with the last to cease. It would be prolonged, which is the very effect that must be avoided in long-distance telephony. Its edges should be cut off instead, and this is what the arrangement of Mr. Gillett does. When

the impulse begins to rise in one secondary coil before the rest it finds a "return conductor" by dividing through the other secondary coils instead of being compelled to pass over the line. Even if there are two, three or more of the secondary coils that failed to "wait" for the others, their impulses are all short circuited in a measure by the coils remaining idle. Again, when the next phase of the vibration is about to begin, as soon as one secondary coil weakens or begins to give out it becomes a short circuiting path for the impulses remaining in the others, and thus each one that dies out helps to kill the rest. In other words, we may say that the impulse over the line rises when the secondary coils have become "unanimous" in action, and ceases when some of them fail. These coils, in fact, fulfill for each other the office performed by a condenser to the primary circuit of the Ruhmkorff coil. They widen the interval between the impulses, and thus leave a wider margin for the "tailing" which these impulses must anticipate in long-distance telephony.

Fig. 1, shows the interior the four-point instrument, and Fig. 2 shows its interior arrangements. A screw passing through the centre of the disphragm serves to hold in place a cup shaped disk to the margins of which, at equidistant points, the four contact needles are fastened. The carbon grains into which they penetrate are contained in a hollow, inside four screws, and these are held by four curved brass arms, screwed to the ring around the margin of the diaphragm, though insulated from it. The connections to the batteries and induction-coils are made through the hinges, the four longer ones being connected with the needles and the four shorter ones with the brass arms just described. There are four induction-coils, one for each contact point. Two of them are seen between the generator and bell magnets. One cell of battery is used for each primary circuit, one "return" conductor being used for all four cells, so as to simplify the connections. At the left side of the box is a switch by means of which the primary circuits may be closed or opened. Besides this the apparatus comprises a bell of the kind usually placed in telephone instruments, and also a magneto generator, whose armature contains a great length of wire, and whose magnets are large and strong, so that the impulses generated may be powerful enough for overcoming long distances. In connection with this and his other transmitters Mr. Gillett uses a receiver of special form, invented by himself. In Fig. 1, one of these receivers is shown complete at the right side and the parts of another are shown at the top. It consists of a tubular or cylindrical magnet inclosing a central bar magnet. Around the pole presented to the diaphragm by this magnet is placed a spool of fine wire, as in the Bell receiver. Some fine wire is also wound on the outside of the tubular magnet around the pole presented to the diaphragm which is of a polarity opposite to that of the central bar magnet. With this form of receiver the magnetic attraction of the diaphragm is produced over a wider surface. Moreover as the action of both poles is made available, each radius of the diaphragm becomes practically the armature of a U magnet, and its "keeper" as well. The vibrations produced are more energetic and the articulaton which results is therefore louder.

Figs. 4 and 5 represent the ten-point transmitter. The diaphragm is in this case placed on the left side of the box instead of being placed in the door. The sound waves are conveyed to it by a speaking trumpet, as shown in the figure. The ten "points" are disposed in a circle. When seen in vertical cross section through the centre of the diaphragm the arrangement is as shown in Fig. 3, with the stem *V* and the right-hand portions left out. The diaphragm *D D* is screwed to a metallic ring. By means of a screw passing through its centre it holds the cup-shaped disc *R* of india-rubber, whose rim is flattened. The needles *n n*, attached to shoulder pieces, are fastened in place by screws passing through the rim *r. r.* Between the shoulder-pieces and the rim are interposed metal-washers to which a wire *p*, intended for making the connections is soldered. The wires *p*, from the the "other side" of the contacts are connected to curved brass arms *F* that hold the screws *S s* in line with the needles. The screw at the upper left-hand side is shown in section, in order that the exact manner in which the contact is made may be seen. First there is a plug of elastic rubber *e*, shown in black, which is from one eighth to a quarter of an inch in thickness. The carbon particles *C* occupy a space of about the same length left between this plug or cushion and another which is also shown in black. The screw *s* is free to turn inside the chambered screw *S*, and by turning it the compression of the carbon particles can be regulated. The needle *n* passes through the first rubber cushion (*e*) which is suitably bored for the purpose, and it projects into the mass of carbon particles, about one thirty-secondth of an inch more or less, according to the adjustment. The ten induction coils used with the ten points of contact are placed in the bottom of the transmitted box in a frame as seen in Fig. 5. Two cells of (Bergmann) battery are used for each contact point. At the right side is a kind of radial switch provided with a lever on the outside, by moving which the primary circuits may be closed or opened. Each of the secondary coils has a plug connection at the right side of the box, and by withdrawing this plug it can be excluded from the circuit. It is possible, therefore, to use the points of this instrument either singly or in any desired groups. At the lower part of the right side is also a plug switch by means of which the line may be transferred to a magneto and bell apparatus.

In the experiments which Mr. Gillett has been carrying on over the wires of the Postal Telegraph Company some very satisfactory results have been obtained with these ten-point instruments. Between New York and Meadville, Pa., where Mr. Gillett's assistant is at present located, a distance of 509 miles, the transmission is a great success. The articulation is indeed quite as clear as distinct, and as loud as between any two telephonic stations in a city. Conversation can be carried on with perfect ease, and it is not even necessary to raise the voice, for even a message in whispered tones can sometimes be understood. We have conversed successfully over that distance when using only one point though the articulation is not quite as clean or as loud--probably for the very reason that the impulses are not so well defined, as already explained.

Conversation has also been carried on between Washington and New York with equal success—320 miles. Experiments have been made between Cleveland and also between Chicago and New York with success, though the transmitters were not then fully adjusted. These experiments will soon be repeated over again, this time, it is hoped with as good success as between here and Meadville. The experiments will extend to St. Louis, *via* Chicago,—about 1,400 miles.

Last, but not least, of the instruments which Mr. Gillett has constructed, is the "twenty-pointer," a giant among transmitters, and one with which its inventor expects to attempt the daring exploit of ocean telephony. This instrument is shown complete in Fig 5. Fig. 6 is a rear view with the box partly removed to show its construction. This instrument is in reality a ten-point one doubled by the addition of an extra group of ten points behind and in a line with the first ten.

The exact manner in which this is contrived is shown in diagram in Fig. 3. The chambered screws (*S*) of the second group are held as before by curved arms (F_2) which are screwed to a ring *O*, from which they are insulated. This ring is held by converging supports *P P*. The contact needles of this second group are attached like those of the first to a circular piece R_2, which is hollowed out, but after the manner of a funnel instead of being cup-shaped. This funnel is screwed to a stem *V*, which is itself held secure to the diaphragm by the same screw that holds the first disc. Thus it will be seen that the motion of the diaphragm must be conveyed simultaneously to all the contact points. The structure which holds together the diaphragm and these chambered screws may be removed at pleasure, the connections to the points being make by metallic springs disposed radially around the margin of the opening in the box (Fig. 7). The induction coils are supported in a frame as in the ten-point instrument. There is also a radial switch, by means of which the primary circuits are manipulated, and in the front of the instrument a system of plug connections, the upper double row being for the secondary coils and the lower four rows for the primary circuits, which can thus be operated singly or in combinations. There are two cells of battery per contact in this case also.

This instrument has not yet been fully adjusted and no special tests of its capabilities have been made. These tests will, doubtless, be made before long. The inventions of Mr. Gillett are covered by patents in England, France, Belgium and Germany, and these patents, including those for this country, are now owned by a company recently formed—the Allantic and Pacific Telephone Company. Mr. E. R. Wiggin, of Boston, who has seconded the efforts of Mr. Gillett for the last year or more, is president of the company.

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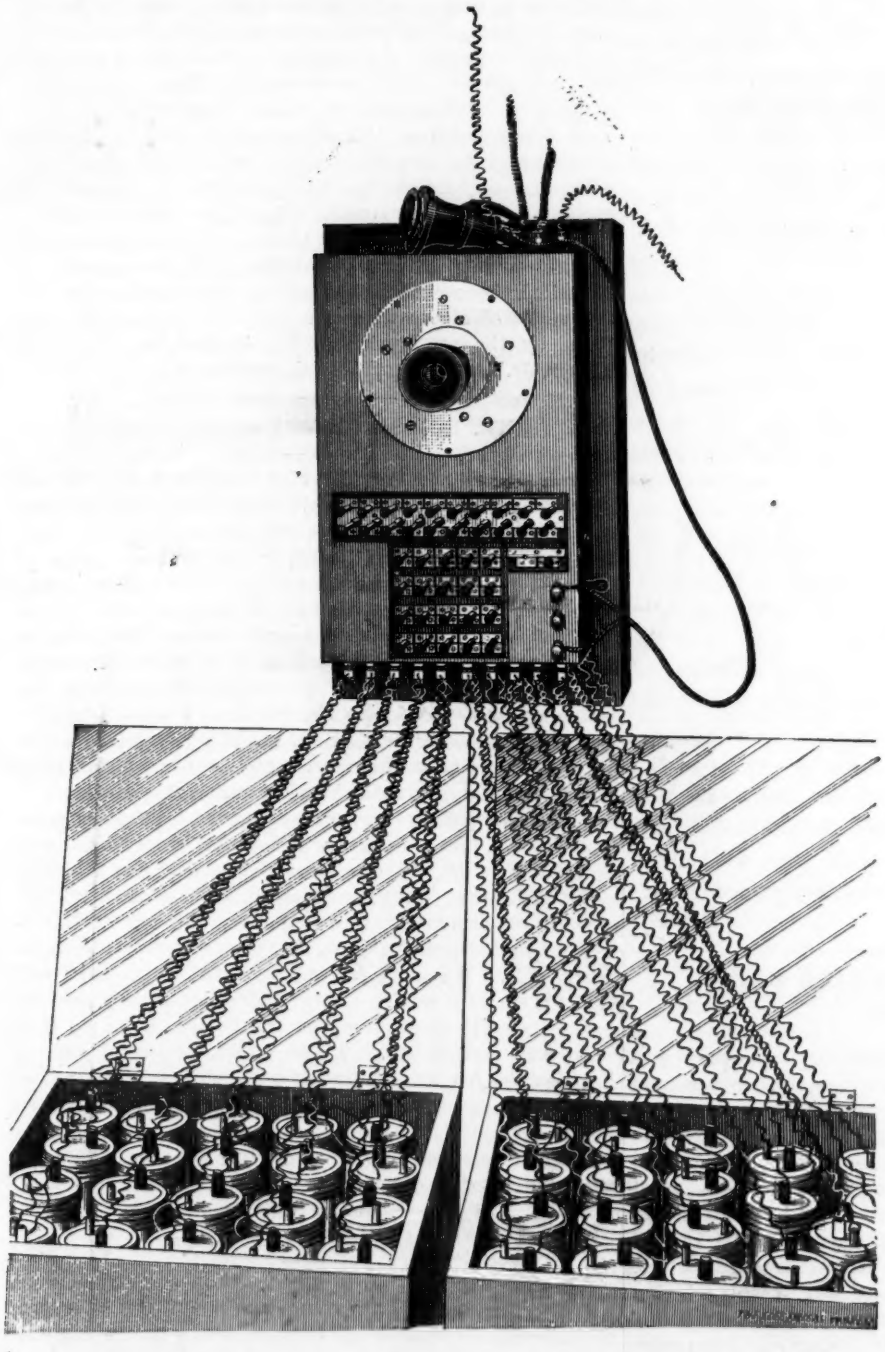

FIG. 6. THE TWENTY-POINT TRANSMITTER—CLOSED.

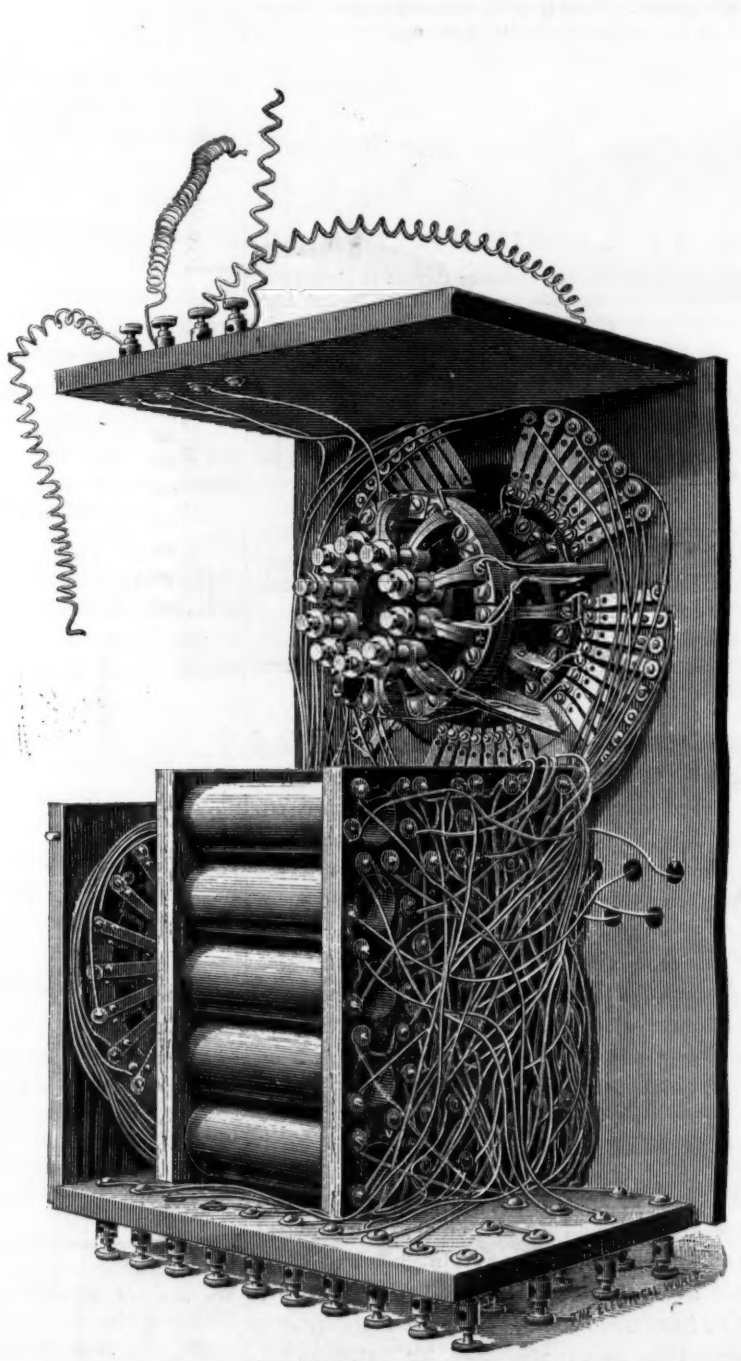

FIG. 7. THE TWENTY-POINT TRANSMITTER—SEEN FROM THE REAR.

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UNTIL THE END OF THE YEAR.

Those wishing to subscribe for THE ELECTRICAL WORLD from the present time until the issue of December 27, 1884, can have the paper sent to them during that period, postage prepaid, for $1.50. We can supply a few complete sets of back numbers from the beginning of the year to such as prefer having the file for 1884 complete. A remittance of $2 will cover the expense of the back issues and also of the remaining copies of the year. Present subscribers will oblige by calling the attention of non-subscribers to this matter, and endeavoring to secure a few subscriptions for us, either for the year at $2, or from April 5th until December 27th, 1884, at $1.50.

THE FUTURE OF THE TELEPHONE.

One by one new uses are being found for the telephone. Its latest developments and improvements are significant of a future for it far in excess of anything hitherto experienced, great as its present serviceability may be. In speaking of its future, we do not refer to its potentiality of wealth beyond the dreams of avarice, for that, after all, is a matter which relates only to the interests of a few capitalists and stockholders, but we have in mind the benefits to be enjoyed by all from the means of more rapid, perfect and immediate intercourse and the transmission of news, time, signals, fire alarms and the like.

Long-distance telephony is big with possibilities, many of which promise to become certainties at a very early date. The Bell Company has made some very successful tests on lines between Boston and New York, and does not rest satisfied with the achievement. The present number of THE ELECTRICAL WORLD contains a valuable and interesting article, profusely illustrated, on the multiple-point telephone of Mr. Webster Gillett. This instrument, as will be noted, has already given most satisfactory results over distances of several hundred miles. It is said that the gentlemen interested in this telephone are sanguine of conversing across the ocean with it; and, with perfect insulation and buoyed relay stations, this may in time be accomplished. We may at least prepare ourselves for long-distance telephony on land.

But these applications and the now well-ascertained feasibility of using the telephone on telegraphic circuits, do not exhaust the utility of the telephone. Capt. Lina Beecher has indefinitely extended the possibilities of the instrument by his inventions and devices in portable telephone apparatus. He is the first and original inventor in this field, the vastness of which is not yet realized. The portable telephone system comprises means of communication by telephone between a fixed and a moving point or between two moving points, ashore, afloat, in the air, under ground or under water. By its means communication can be effectively maintained in secret between the different corps of an army in motion, or the ships of a squadron, or between a fort and a ship, or a ship and a boat. It will thus prove of peculiar value to the military and naval branches of any government. Its use marks a new departure in torpedo practice and service, and adds immensely to the safety and rapidity of all operations in diving. There is a demand for it also in railway construction, land surveying and exploration.

But the advantages of a portable telephone system go far beyond any above enumerated. The time is not distant when every ocean steamer carrying passengers will be required to supplement with a portable telephone apparatus its life saving boats, belts and other appliances. Our readers will recall with a moment's thought many instances in which this means of communication in foggy or stormy weather—the late wreck of a passenger steamer near Halifax, for example—would have saved life and property. Even for freight steamers lying off shore or in harbor the apparatus will often be found useful. In sewer inspection, mining, and underground work generally it is wanted, and will soon be employed. The occasions are, unfortunately, not few when it would help to save the lives of men caught in a disaster like that which happened in a Virginian mine two or three weeks ago. A rescuing party provided with the light, portable telephone apparatus, could dare and venture much.

It is, however, in connection with fires that the practicability of the invention is soonest appreciated. As arrangements are now, the chief of a brigade and his men labor under the serious disadvantage of being unable to communicate with each other when at work, and the more desirable it becomes to give and receive orders the more difficult it is to do so. But with portable telephones the difficulties are obviated, and the most urgent instructions can be given instantly from the housetop to the street or *vice versa*. This means a great deal, now that buildings are so lofty. We have said already that all passenger steamers will carry the apparatus, and we believe, too, that every fire department of any importance will insist on being furnished with it.

GOVERNMENTAL TELEGRAPH BAITS.

A few weeks ago we published the scheme under the operation of which the Postal Telegraph Company was willing to become a governmental agency for the performance of telegraphic business. Since that scheme was presented to the consideration of Congress, Dr. Norvin Green has again gone before a committee. He opposed all pending propositions that looked to the establishment of postal telegraphy, but he advised a purchase of existing lines in case the government and people were determined to add to the paternal functions of a centralized power. We are not greatly surprised that the Western Union Company should thus announce once more its willingness to sell out. The prospect of prolonged competition with companies that have good backing and carry no dead weight of watered stock would in and of itself be a strong inducement to the company to "unload" on the country; and then the probability that it may have to put many of its lines under ground at a great expense is not very reassuring with regard to dividends. Moreover its cable business is attacked and its stock quotation company has of late found an active rival, so that, altogether, the company has sufficient warrant for its readiness to retire from business—for a consideration.

Dr. Green says, however, that if reasonable rates were adopted the Western Union Company would tender for the contract. It remains to be seen how far the various companies would underbid each other. Mr. George D. Roberts made a very long argument on the 15th before the House Committee on the subject of the bill favoring an exclusive arrangement between the government and the Postal Telegraph Company. He pleaded that it would add to the postal department a new branch for which the people were clamoring; would guarantee a very low maximum rate for the period of ten years, during which the company would gradually cover the country; would stimulate a vigorous competition in service and rates among other companies, and would prevent the absorption of the smaller by the larger corporations, after the old, familiar style. But his opponents claim that the bill would give the Postal Company a monopoly ruinous to all its competitors.

CHEAP EXPERIMENTAL APPARATUS.

We publish in this issue the first of a short series of articles by Mr. Thomas R. Taltavall, of the Asssociated Press, on "How to Construct a Cheap Galvanometer." Even the least-informed of our readers knows that galvanometers, as ordinarily made and sold, are expensive articles, and are at once too dear for the average pocket and out of keeping with the other supplies and apparatus that the electrical tyro can obtain for a mere trifle. Mr. Taltavall describes, and himself illustrates with considerable artistic skill, the manner in which any one having a little mechanical ingenuity and a modicum of patience can make a cheap and trustworthy galvanometer. "Half of our book-writers," says Prof. Tyndall in a trenchant passage, "describe experiments which they never made, and their descriptions often lack both force and truth; but no matter how clever or conscientious they may be, their written words cannot supply the place of actual observation." Now Mr. Taltavall has done what he tells about, and, more than that, he shows by drawings how the various parts should look separately and assembled.

In making such an instrument and using it the student will also, as Prof. Tyndall otherwhere remarks, be getting the best kind of training, the discipline that requires observation, reflection, the exercise of reasoning on phenomena, and experimental verification. There was a time when man stood before Nature as an exclamation point or note of awe and wonder, and he learned nothing. He now stands as an interrogation point; experiment is the language in which he couches his questions to her, and the replies come so laden with information that he cannot master it all. Nothing would please us more than to know that all our readers were "puzzling out" the meaning of electrical phenomena for themselves and learning the use and value of electrical apparatus. We propose to help them by the publication of Mr. Taltavall's, Mr. Wm. Maver, Jr.'s, and like practical articles.

MR. EDISON ON THE SITUATION.

An interesting little "interview" had with Mr. Edison appeared in the *Mail and Express* this week. Mr. Edison, as might be expected, speaks very hopefully of the prospects of his incandescent light, which, he says, is now in full operation in thirteen cities in the United States, while some seventy or eighty plans are in hand for other cities. In New York the full capacity of the stations down town is sold, there are 147 applications that cannot be met at present, and arrangements are nearly completed for the two big uptown stations. Mr. Edison is known to be of a cheerful, optimistic disposition, but if he were inclined to be melancholy this demand for his electric light system would be enough to make him bid dull care begone.

As for his electric locomotive, the time for that is coming, he says, but he doubts whether that or any other will be introduced on the great arterial roads. But the chief point of interest in the conversation is his remark: "We want to get electricity from coal direct without the intervention of boiler and engine. A good many people are at work on it. We don't see our way at all to it, but I will say it is surely possible. Zinc and other metals we can get into electricity at once, but the trouble is to do that with coal and carbon. If we could, we would get six horse-power from one pound of coal, while with the boiler and steam engine we get only one horse-power from three pounds of coal." That is a large cud to chew on, and, as Mr. Edison suggested, if we can solve that power question we can do anything.

Attractive to Fish.

An authority on fish, in conversation recently with a *Sun* reporter, said: I saw some experiments in a European aquarium some months ago that showed what fishing was coming to. The tank was darkened; in fact, the whole room was, and a man in a diver's outfit entered, wearing one of the new electric lights on his helmet. The effect was curious. The tank was perfectly illuminated, but the most remarkable feature was the effect it had upon the fishes. One and all they crowded about the light, seemingly astonished at the strange appearance. The man carried a small scoop net with him, and with the greatest ease caught all the fishes he wanted. If this could be used on the Grand Banks in 200 feet of water there would be a revolution in fishing. The steamer of the United States Fish Commission has been trying some curious experiments with long fishing lines that had electric lights placed just above the bait. These were more or less successful. One trouble that is shown in the tanks at Fulton Market is that the fish become habituated to the light, and after a while will not approach it, but in the open sea, where new fish are continually met with, this would not be an obstacle.

TO SUMMON ASSISTANCE IN ACCIDENTS.—Acting upon the resolution of the New York Board of Aldermen asking the Park Commissioners to devise some better means of summoning assistance in case of accidents, the Commissioners have arranged to have telephones in various parts of Central Park, connecting with the Arsenal Building, whence wires will be run to the East Fifty-ninth street police station, the Riverside drive and Eighty-eighth street, and the Roosevelt, Presbyterian and Ninety-ninth street hospitals. In the course of a few weeks the system will be perfect.

How to Construct a Galvanometer.

BY THOMAS R. TALTAVALL.—PART I.

Few students of the science of electricity enjoy the benefits to be derived from the use of experimental apparatus in accompaniment with their studies, principally on account of the great cost of such instruments. With a view to supplying this want, the writer has undertaken the task of giving a few plain directions for the construction of a

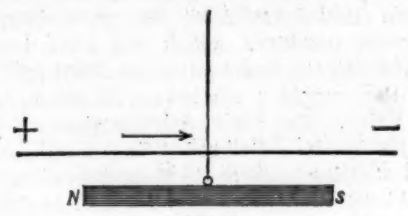


FIG. 1.

good galvanometer at a comparatively small cost. In addition to these instructions, however, ordinary mechanical ingenuity and patience are necessary elements to insure success in the work.

The galvanometer is the most important instrument of all used in the investigation of electrical phenomena. A brief review of its fundamental principles will be proper at this point.

If we hold a wire over and parallel to a suspended or pivoted magnetic needle and pass a current of electricity through it (see Fig. 1) the needle will be deflected from its normal position, and will tend to take a position at right angles with the wire. Under the conditions represented in this figure (the arrow showing the direction of the current through the wire) the north end of the needle will be urged *from* the reader and the south end *toward* him.

If we bend the wire back under the needle, as shown in Fig. 2, we will, with the original current, get about double the original deflection. [The conditions in this case being the same as those in the one above, the deflection of the needle will, of course, be in the same direction as before.] We are led to infer from the latter phenomenon that doubling the wire back under the needle has doubled the effect thereon. This deduction is correct. It is evident, therefore, that if we wind the wire around the needle any number of times the deflection will be proportionately great.

If we reverse the direction of the current through the wire and repeat these experiments, we will observe that the deflection of the needle is also reversed. This is in accordance with a certain law, and it shows us that we can always determine the direction of a current by the deflection of the needle. An instrument embodying the foregoing principles is called a galvanometer.

A galvanometer consists essentially of a coil of insulated wire, a delicately suspended magnetic needle and a graduated scale, by the aid of which we are enabled to interpret intelligently the movements of the needle.

The coils of most galvanometers are usually subdivided into sections of various lengths and resistances, generally four or five in number with resistances of 0, 1, 10, 50, and 100, or more ohms, respectively. Such an instrument has a wide range of usefulness.

The first coil around the needle is the one of lowest resistance, and need not necessarily be of wire. Generally it consists of a band of stout copper passed once around, the resistance of which is practically *nil*. The copper band has one important advantage over a coil of wire of equal resistance, and that is, it takes up less space.

The other coils are made up of insulated copper wire of proper lengths and gauges to secure the desired resistances.

These features in construction will be adhered to in the

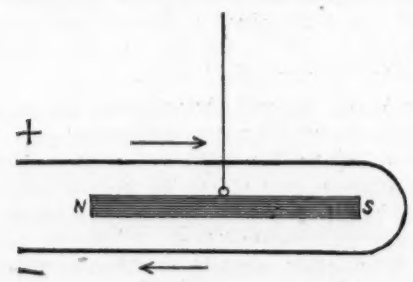


FIG. 2.

following plan, so that an instrument sensitive enough for all ordinary requirements will be the result of our labor.

Now we come to the work in hand. The base of the instrument should naturally receive our first attention. It must be of well-seasoned hard wood. A regular instrument base, about 6 × 8 inches in size, all finished, can be purchased of any instrument maker for about a quarter of a dollar, and will answer our purpose excellently. Of course a plain piece of wood of these dimensions will answer fully as well as a finished base, but it will not make as pretty an instrument. This is the only point of difference. In either case the wood should be three-eighths or half an inch thick.

Next, locate the centre of the base. The easiest way to do this is to take a pencil, or anything else that will make a mark, and draw lines on the under side connecting the diagonal corners. These lines will intersect each other at the centre. This central point may be regarded as the plumb-line of the whole structure, and on it much will depend at a certain stage of our work.

Now we come to the most important part of the instrument—the superstructure. This consists of the coil and its frame, the needle, the graduated scale, etc., etc.,

The first thing to do is to make the frame on which the wire is to be wound. Get some thin wood and cut two rectangular pieces, 3 inches long by 1½ wide (see Fig. 3). Cigar-box wood is the best for this purpose. It possesses the advantages of being of convenient thickness and easily worked, and it finishes up well, resembling mahogany somewhat, after receiving a coat of oil or varnish. Cut a hole in each piece, 1 inch long by ¼ inch wide, as shown in Fig. 3. These holes will be the open ends of a box which is to contain the magnetic needle.

Now, construct a box of the following *inside* dimen-

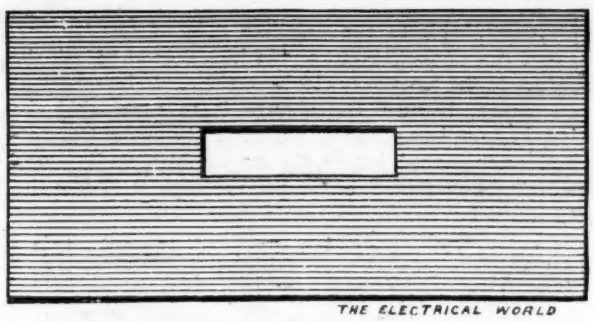


FIG. 3.

sions, viz.: 1 inch long, 1 inch wide and ¼ inch deep, leaving two ends open as shown in Fig. 4 (only one open end is visible in the figure; the opposite end is, of course, assumed to be open also). Thinner wood should be used for the top and bottom than for the side pieces. The reason of this is to allow us to get the coil as near the needle as possible, and consequently secure the greatest possible magnetic effect thereon. Cigar-box wood, shaved down to one half its original thickness, will answer the purpose very well. Making the end pieces of heavier material gives the structure greater stability.

The next step is to attach the rectangular pieces to the box. This must be done in such a manner that the openings of the box will coincide with those in the first-named pieces. Fig. 5 shows the frame completed. The part may be put together with glue, or with brass brads, or both. Under no circumstances use iron brads, or anything else of iron or steel, in the construction of your galvanometer. These metals, however small in mass, have a more or less disturbing influence on the needle.

The frame is now ready to receive the copper band and coil of wire. First cut the copper band the shape shown in Fig. 6, of the following dimensions: length of each of the narrow strips, 5 inches; width of same, ¼ inch; length of broader portion, 2½ inches; width, one inch. The copper should be of No. 32 gauge. This is the most convenient thickness for this purpose. The broad part of the band is just long and wide enough to cover the entire external surface of the box, within the upright pieces. The narrow strips serve the purpose of wires to connect the band with the binding posts. This method of making the connection is far superior to any other, inasmuch as there are no solder joints to create inequalities, etc., and it is economical in the matter of space. Moreover, equally as great, if not more material, is obtained in the strips than would be by using a heavy wire. This latter advantage means less resistance, which is a quality to be attained in as great a degree as possible in the band. Ten or fifteen cents ought to cover the cost of the strip of copper.

(TO BE CONTINUED.)

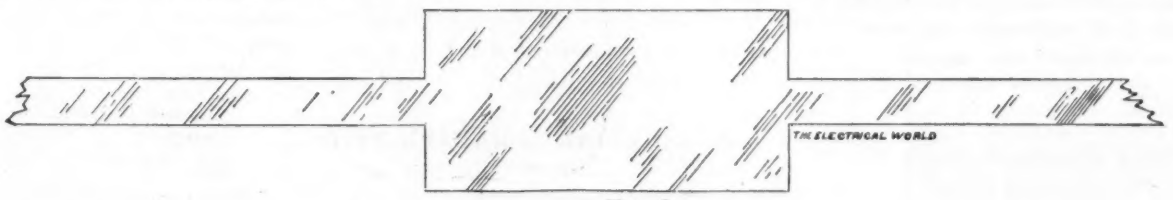


FIG. 6.

Telephonic Interests in Mexico.

The annual meeting of the Mexican Telephone Company was held in New York on April 10. The following-named gentlemen were elected directors for the ensuing year: F. B. Beaumont, E. B. Welch, F. E. C. Bryant, A. L. Hayes, Wm. Reed, J. F. Hawley and J. H. Goodspeed. President Beaumont's statement to the shareholders represented the company to be in a promising condition. When the present management took charge, July 1, 1883, a debt of $12,000 in June had increased to $28,000, and a further issue of 25,000 shares of stock was decided upon. This was sold at $2 per share, and from the proceeds the company paid its debts and entered upon a policy of active development. The Mexican parent company bought the Guadalajara property, which had March 1, 1881, 155 instruments connected with a trunk line to Ameca nearly finished, which would add 100 more. It also had 490 instruments in operation in the city of Mexico. The earnings from March 1, 1883, to March 1, 1884, were $28,000, the expenses

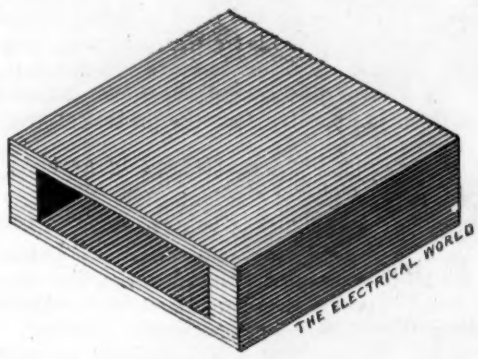


FIG. 4.

$11,800, leaving net $16,200, of which $9,000 was applied to the cancellation of claims, leaving $7,200 for construction. General construction was to be closed April 1. The company receives $5 per month rental for instruments in the city of Mexico, $3 in Guadalajara, and $6@12 on suburban lines. Its exchanges are now earning $3,000 gross and $1,300 net per month, and the outlook is every way encouraging.

The total number of telephones owned by the company March 1 was 2,907; in hands of parent company, 845; leased to sub companies, 2,907. The number of instruments in use by sub companies was: Vera Cruz, 125; Mexican Central, 400; Chihuahua, 300; Mexican Peninsula, 200; Mexican Pacific, 254; Mexican Northern, 221; Puebla, 251; Mexican Interstate, 100. Tepic, 11; Durango, 200. The stock in sub companies owned by the Mexican Company was: Mexican Peninsula, 6,649 shares; Mexican Central, 7,200 shares; Mexican Northern, 3,700 shares; Mexican Interstate, 4,000 shares; Mexican Pacific, 3,000 shares; Durango, 3,600 shares; Chihuahua, 2,000 shares; Puebla, 3,000 shares; Vera Cruz (in process of organization), 1,000 shares; Tepic, 37; total, 34,186 shares.

The company has no indebtedness in Mexico. The Mexican (parent) company has settled all differences with the Mexican Central (subordinate) company, and under the terms the latter has returned 2,000 shares of stock to its own treasury, scaled its debt from $32,000 to $20,000 and funded it, so as to make it payable in one to four years, assigned the Bell and Blake rights for Mexico to the Mexican (parent) company, and given the latter a four months' note for $2,830, which is practically a first claim on the property. The parent company discontinues its suit against the Central in Mexico, and restores it to an equal footing with other subordinate companies. From a state almost of bankruptcy last July, the present management has raised the company to the level of paying properties, and net receipts are now coming from Mexico. The au

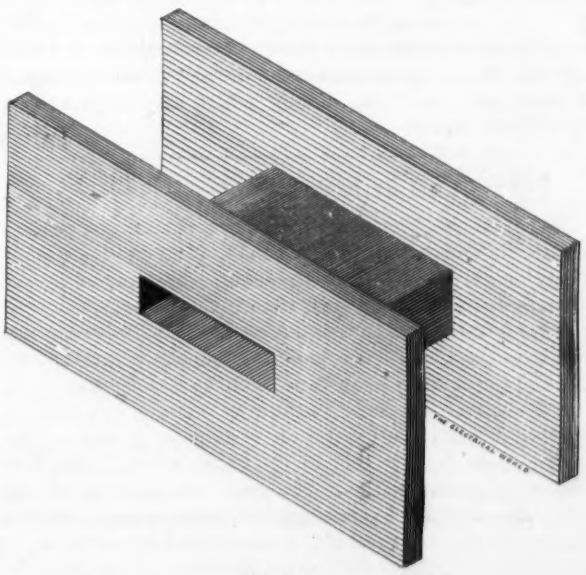


FIG. 5.

thorized capital is $2,000,000, and the issued capital $1,250,000—125,000 shares, par value $10.

A NEW LINE FOR THE FAR WEST.—The chairman of the House Committee on Pacific Railroads has reported favorably a bill incorporating the Spokane Falls & Cœur d'Alene Railway Company. It authorizes the building of a railroad and telegraph line from Spokane Falls, W. T., by way of Fort Cœur d'Alene, to an intersection with the Northern Pacific or Utah Northern Railroad in Western Montana.

REVIEWS OF NEW BOOKS.

THE PRINCIPLES AND PRACTICE OF ELECTRIC LIGHTING. by Alan A. Campbell Swinton. New York: D. Van Nostrand, 23 Murray street. London: Longmans, Green & Co. 1884. Octavo, pp. 172. Price, $1.50.

The author has professedly written for the instruction of those who use electric light, and for "the general scientific public who take an interest in all new discoveries and inventions;" therefore he has tried to avoid the use of technicalities and to make his treatise easily understood by unscientific readers. Some readers are satisfied with this pabulum, for it gives just enough superficial information to enable them to appear before the great unlearned as oracles of science.

As in all cases where authors attempt to avoid technicalities, the definitions and descriptions are imperfect and perplexing, but are of sufficient value to set the aforesaid oracles up in business; to excite the thirst of the electrical student for other and more advanced works, and to repay the cost to the expert in the science and art by the showing of apparatus not before printed about in books.

After an introductory, which is prophetical, explanatory of past failures due to speculation, dishonesty and imperfect knowledge of the subject, and hopeful as to the future, the author takes up in the several chapters the Theory of Electric Lighting; Electrical, Mechanical and Photometrical Measurements; Sources of Power; Dynamo-Electric Generators; Arc-Lamps; Semi-Incandescent and Incandescent Lamps; Electric Accumulators; Electric Lighting Systems; and, finally, the Electric Light in its Various Applications, its Advantages and Cost.

This is an excellent arrangement of the chapters of the book; is practically sequential, because the reader progresses step by step through the mazes of the subject as the sixty-days' tourist "does Europe," in company with other "doers," the machine-tongued guide and the handbook—from Liverpool to the final port of departure for the climes with which he is familiar. To this tourist it matters very little whether or not Rome was built in a day, or whether Columbus was born in Genoa or Limerick; he has been and seen, and has added to his stock of something to be talked about, and is a little bigger man in his own and others' estimation as a consequence of his trip.

In the same way in this book it matters very little though the reader be told that in a galvanic battery "a current is set up in a circuit from the copper plate through the wire into the zinc, and then back again into the copper through the acidulated water;" that "an ampère is the strength of current capable of decomposing 1.4472 grains of water in a second of time;" and that electric accumulators "are made in sizes to store from 400 to 2,000 ampères of current;" and though the diagram of the Pilsen lamp shows the double-cone core very much too short. These are errors in the eye of the expert, which need not affect the class of readers for which the book is intended.

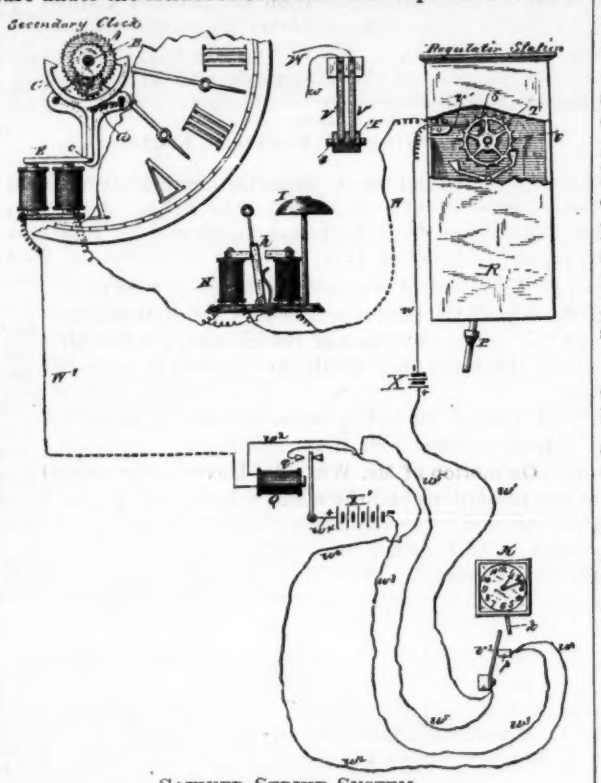
Everybody on this side of the globe knows to the contrary of the statement that "the Wallace-Farmer lamp is used to a considerable extent in the United States." This must be ascribed to that remnant of ignorance in the United Kingdom of matters in this country, which the visits and writings of Matthew Arnold, Oscar Wilde and Charley Rowell are expected to efface. We are told that "Mr. Thomas Alva Edison, the well-known American inventor, has brought out an incandescent lamp which differs in detail only from that of the Swan." When will we aspiring Americans succeed in being foremost, first, and original in British eyes? We are under the belief that Swan's lamp is like Edison's except in detail. But this does not affect the practical value of the book. Both lamps give light; the book says so, too, and it also gives a good, general idea why and wherefore. In short, it is the best book on the subject within its modestly stated scope, we have seen, and the money which may be paid for it will be well invested. K.

Sawyer's Strike System for Electric Clocks.

One of the objections which have been urged against electric time-distributing service is that no audible signals are given at proper times to denote the time of day or night, such as we have been used to in our hourly experience with mechanical time-keepers. This objection has been overcome, and now we may hereafter gratify our ears and expectancy as to time such as is doled out to us from a central station. By the way, man is fast coming to living under a central-station system in all things, and electricity is the last link in the chain which holds him a slave to centralization. He gets his food, clothing, light, time, telephonic conversation, information, and even religion from, or through, central stations; and he is deposited in a central station for his final resting place.

This time-striking system is the invention of Mr. William H. Sawyer, the Electrician and Superintendent of the American Electrical Works in Providence, R. I. Its operation is as follows:

When the segment S is out of contact with fingers V and V' there is no current on the clock-circuit, and the armature of the secondary-clock magnet is retracted by spring G. At this time the current of the large battery X' is also broken by the relay. When the segment S comes in contact with the fingers the circuit of battery X is closed and the secondary-clock magnet operates; and when said segment passes out of contact with the finger the circuit is broken and the spring G operates the armature and anchor. As the segment is fifteen-sixtieths of the circumference of the wheel T, the clock-circuit remains closed fifteen seconds, and during this time the relay holds closed the circuit of large battery X'; but the current of this battery will not flow on the main line so long as spring-finger V, is in contact with pin p, but flows over the shunt-circuit formed by wires w^4, the relay-armature and contacts, wire w^5, spring-finger V^2, pin p, and wire w^3. Simultaneously with the coming of the segment S in contact with the fingers for the last time at the end of a regular hour, the striking mechanism K is operated to strike the number of the hour, and each time the hammer k strikes the spring-finger V^2 the shunt-circuit is broken and the large battery sends on the main line an impulse in opposition to the circuit of battery X, and for a brief time overpowers the said battery and causes the polarized magnet of the secondary clock-striking mechanism to strike its bell. It will be seen that when the shunt-circuit is broken the current of the large battery X' will flow over wire w^4, the relay armature and contacts, wire w^5, wire w' through battery X in opposition to its current, over wire w, spring-finger V', segment S, spring-finger V, line-wire W, through polarized magnet H, secondary clock-magnet F, over line-wire W', through magnet of relay Q, over wire w^2, pin p, and wire w^3, back to the negative pole of the battery. The reversals of the current on the line do not permit the armature of the secondary clock-magnet F to be retracted by its spring, because the change is so rapid that the spring does not have time to act after the current of battery X is neutralized before the magnet attracts its armature under the influence of the reverse impulse. The entire



SAWYER STRIKE SYSTEM.

number of breakages of the shunt-circuit for striking the hour must of course occur during the time the clock-circuit is closed by the segment S. Fifteen seconds are found to be ample time for the striking, and even a less time—say, ten seconds—would answer.

The relay Q might be omitted, and the wire w^4 lead direct to spring-finger V^2; but then the current of battery X' would continue to flow on the shunt-circuit except when it is broken by striking, and for economy there is used what is called an "open-circuit battery," and it is kept open three-fourths of each minute.

THE ROYAL ELECTRIC CO., CANADA.—The capital of this company, which, as we have previously announced, takes over the Thomson-Houston business for all Canada, is fixed at $250,000. Among the provisional directors are Mr. C. F. Sise, Vice-President of the Bell Telephone Co., and Messrs. M. Lee Ross and H. E. Irvine, the last two gentlemen taking the joint management. It is said that the plant in Montreal of 125 lights will be sold to a local company. A 100-light station is in progress for the city of Kingston, and negotiations are in progress for lighting Toronto, Belleville, Guelph, Halifax, St. John, N. B., Galt, the Harbor of Montreal, the government canals, the boats of the Richelieu & Ontario Navigation Co., the church of Notre Dame, Montreal and orders are in hand for lighting several mills and factories in Ontario, Nova Scotia and New Brunswick. The purchase money paid to the American Electric and Illuminating Company is $200,000. The offices of the company are at 162 St. James street, Montreal.

INSULATION.—M. Weideman insulates metal wires in this way: He prepares a bath of plumbate of potash by dissolving 10 grammes of litharge in a litre of water, to which 200 grammes of caustic potash had been added. Having permitted the solution to rest he decants it, and the bath is ready for use. The wire to be covered with the insulating skin or film is connected to the positive pole of the battery, and a piece of platinum is attached to the negative pole. Both the wire and the platinum are then plunged in the bath, when metallic lead in a very finely divided state is precipitated at the negative pole, and peroxide of lead on the wire, causing it to assume all the colors of the spectrum, but a brownish black tint indicates the highest degree of insulation by this process.

Notes Around Philadelphia.

We give in this issue a few more notes made during our recent peregrinations. This time Philadelphia is the city under survey.

The Brush Electric Light station, at Philadelphia, is one of the finest to be seen anywhere on this continent. The building is of one high story, 90 × 106 feet. The power is derived from a pair of Corliss engines capable of developing 500 h. p., and eight Porter-Allen 50 h. p. engines. These serve 19 dynamo machines, which will have a capacity, when the new armatures are put in, of about 1,000 lights. At present they supply a current to 725 lamps, of which 200 are day lights. The Porter-Allen engines are coupled direct, but the Corliss distribute their power by means of two lines of shafting. There are 25 exterior circuits. The switchboard is admirably arranged for making connection from any machine, and each machine has a current-switch and a tablet for showing what are the connections of each machine for the day. The plant is worked with a great deal of care and system. Tests for ground are made over the lines day by day; every fire alarm is followed up by a man from the station in case electric light wires have to be cut, and there are attached to the station repairing, testing and supply branches. The dynamo room is 66 × 64, and the boiler room 38 × 66, and it is proposed now to put another story on the building for more dynamos to run Swan lamps, with storage batteries.

The Thomson-Houston Electric Light Company of Philadelphia control the territory of Pennsylvania, New Jersey, Delaware and Maryland. They give attention principally to private plants. They have recently put in an installation of 50 lights for the Reading Railroad Co. in Philadelphia, and another at Locust Point for the B. & O. Co. The Phœnix Iron Works, of Phœnixville, have taken an installation of 16 lights, and the Lackawanna Coal and Iron Co., of Scranton, have one of 15 lights. The installation for the Cambria Iron Co., of Johnstown, comprises 25 lights, and the American Shipbuilding Company, of Philadelphia, has its installation so arranged that the lights are portable. Twenty lights have been put in the worsted mill of James Doak, Jr., & Co., Philadelphia, and there are 12 lights on board the tow boat "J. B. Williams." The Bethlehem, Pa., Electric Light Co. have recently been supplied with plant for 25 lights.

The Maxim Company, in Philadelphia, has a good share of electric lighting business, and the Excelsior Company's lights are seen on the streets though the circuits lie underground in some of the numerous conduits. The Edison light is also to be seen in some of the buildings in the city.

The old and well-known firm of Partrick & Carter, 114 South Second Street, are, perhaps, paying just now more attention to annunciators, electric bells and the like than to the other departments of their large business; and their annunciator is in high repute all over the country. They have recently issued a catalogue of electric toys, motors, and turntables. The toys are remarkably ingenious, the motors bringing the practical operation of the larger machines within the comprehension of children, who, while they thus get a grasp on great principles, cannot fail to be amused. Several of these motors are adapted to the effective display of novelties in store windows and showrooms. Mr. Partrick, of this firm, has large shipping interests, and is at present off on a Caribbean cruise in one of his vessels. The electrical business of the firm is in charge of Mr. Carter and Messrs. C. M. and E. Ward Wilkins, who were made partners at the beginning of the year.

It may be doubted whether any firm in this country is more honorably and prominently connected with the development of physical science and study than James W. Queen & Co., 924 Chestnut street. They have been interested "time out of mind" in the manufacture, importation and sale of physical apparatus and supplies, mathematical, optical and philosophical instruments; and the purchaser knows that he will be satisfied with whatever he purchases from their establishment. The important department of electricity and magnetism is not at all neglected, and the mere enumeration, with illustrations, of their instruments and supplies for experimental purposes fills about fifty pages of their last catalogue. The whole science is covered by the list, and the most complete laboratory could be fitted up from it.

D. Frisbie & Co., 481 North Fifth street, are enjoying an active demand for their friction clutch-pulleys to be used in connection with electric light machinery. These pulleys have already been adopted by several electric light companies. Fourteen Frisbie friction-pulleys are used in the station of the Providence R. I. Electric Light Co., and the U. S. Company have 17 of them at their station 44th street and 4th avenue, New York. The Maxim Electric Light Co., Philadelphia, have 14 and one cut-off coupling, 300 h.p. The U. S. Post Office plant at Philadelphia has two 300 h.p. couplings.

The strength, efficiency and cheapness of his beltings are points of immense importance to the superintendent of an electric lighting station, and he is therefore interested in the claims made for their Leviathan cotton belting by the Main Belting Co., southwest corner, Ninth and Reed streets. This belting, of 4, 6, 8, or 10 ply, is made to any required length or width, the usual sizes being kept in

stock. It is guaranteed to run straight and to be even throughout, to have no cross joints, and to cling well to the pulley. It is also said to be unaffected by damp.

The Novelty Electric Company, of which Mr. J. Chester Wilson is now general manager, have a very fine store and showroom on that fine thoroughfare, Chestnut street. The company deal in all kinds of electrical instruments and supplies, especially annunciators, electric bells, electric toys, burglar alarms and batteries. They are agents for the Portable Electric Gas Igniter, and if appearances mean anything, are doing about all the business they can look after.

Merchant & Co., 525 Arch street, and of 90 Beekman street, New York, have long done a large business in metal supplies, and of late have been interested in telegraph, telephone and other electric wire, in which direction they appear to be building up quite an extensive connection. They are noted for their seamless tubes, and for their tools and machines for metal working.

The Independent Electric Co., of 1,324 Chestnut street, make a specialty of putting in hotel annunciators and other electrical apparatus of that kind. They are agents for Zimdar's patent pneumatic bell. Their business is by no means confined to Philadelphia but lies in other large cities as well.

A. F. Fleischmann, of 1,226 Chestnut street, has for many years devoted himself to the manufacture of electrical apparatus and the repair of various kinds of electrical instruments. His catalogue gives a long list, with illustrations of medical batteries, magneto-electric machines, induction coils, Töpler-Holtz machines, electric bells and the like.

Business is reported very fair by Mr. A. F. Moore, 200 and 202 North Third street, who makes large quantities of insulated wire for telephone, telegraph and electric light purposes, as well as office, line and annunciator wire, magnet wire and flexible cordage. This is one of the pioneer houses of America in the manufacture of insulated wire.

The Cambria Iron Works, of Johnstown, Pa., have two branch offices in Philadelphia. The Cantier-Steel Department of the company manufactures large quantities of telegraph and telephone wire, which it supplies to several companies and to a number of dealers.

The Electro-Dynamic Co., 224 Carter street, whose motors for family sewing machines are well-known, have been doing excellently with their motors, dynamos and automatic batteries. By last accounts they are now preparing to launch out in new enterprises in order to find employment for their surplus energy and capital.

The Clay Commercial Telephone Co., whose general offices are at 1,017 Chestnut street, have been making arrangements for telephone service. It is said that they will have an exchange open in Philadelphia by June. Mr. Henry Clay is the electrician, and the officers are prominent local men.

St. Johns, Quebec, to be Lighted.

Some years ago Messrs. A. Perry, of Montreal; Chas. Arpin, Alex. Macdonald, G. H. Wilkinson and A. Brosseau, of St. Johns, Quebec, associated themselves together for the purpose of organizing a gas company in St. Johns, Quebec, and something like $10,000 was subscribed, but this being scarcely sufficient to warrant the directors to go to an allotment the scheme was abandoned and the town seemed forever doomed to darkness. Dr. Gustavus Griffin, of the Phœnix Electrical Company for Canada, opened negotiations with the City Fathers about three weeks ago, says the Montreal *Witness* of the 7th inst., and seeing the need of light offered to supply thirty arc lamps of two thousand candle power each, to be placed on the streets and to supply his company's system of incandescent lamps for stores and private use at five cents per light per night. So much encouraged was Dr. Griffin that he gave a free exhibition of both the arc and incandescent lights in the Messrs. Macdonald Stone and Chinaware Company Works and in front of the St. Johns Hotel, which was witnessed by more than half the entire population. After the exhibition was over negotiations were opened with the mayor and aldermen to supply the arc light for street lighting and with Louis Molleur, Esq., president of the Banque St. Jean, to supply the incandescent lamps for the merchants and private use, as he had a large engine at his water works lying idle. Mr. Franklin H. Smith, president of the Phœnix Electric Company, received a telegram on Saturday afternoon last from Dr. Griffin stating that he had closed with the authorities for 2,000 incandescent lamps to be used in lighting the streets as well as the houses, and that more than 200 lights had been signed for by the merchants on Richelieu street. On receiving this news Superintendent McConnon, of the Phœnix, left to assist Dr. Griffin in mapping out the plans for lighting, etc. The Phœnix has received the first contract ever awarded to any company for lighting a town in the Dominion exclusively by the electric light. President Smith with his superintendent, Mr. McConnon, will visit St. Johns during the week to commence the work of laying on the wires and putting up the lamps. This is probably the largest contract ever awarded any company in the Dominion. It looks as though electric lighting will soon be brisk throughout Canada.

Seeking a Foothold in Massachusetts.

If the Baltimore & Ohio Telegraph Company fail to get a foothold in New England, and to gain permission for stringing their lines along railroad tracks, it will not be for want of energy. They are making persistent efforts in every direction to secure an entrance into Massachusetts for their lines. They are pressing with vigor before the Legislature to secure the passage of a bill to permit the occupation of railway locations by telegraph lines, this step being urged as a necessary means to avoid the exclusive features of existing contracts between the railroads and the Western Union Company. The railroads and the Western Union are strenuously opposing the legislation, and the evidence has been protracted to great length. Meantime, the Baltimore & Ohio have made application to all the railroads for the right of occupation upon their locations, and also for such facilities in the transportation of material, including distribution between stations, as have been afforded to the Western Union.

It is understood that the Baltimore and Ohio has material ready for distribution along the line of the New York and New England road, and this railroad, having refused such facilities as the telegraph company desired, the counsel of the telegraph company, Messrs. Parker C. Chandler and Benjamin Kendall, filed a petition on the 11th inst. with the Railroad Commission asking for an investigation and relief. One petition says that they are informed and believe that the refusal is given because of supposed obligations contain in one or more contracts between the New York and New England road and the Western Union, containing provisions designed to prevent or discourage the extension of any telegraph line in competition with the Western Union, which provision the petition claims to be illegal and void, being contrary to public policy, in obstruction of trade, and opposed to the laws both of the United States and the Commonwealth of Massachusetts.

The American Institute of Electrical Engineers.

The signers of the call for the organization of a national electrical society held a meeting at the rooms of the American Society of Civil Engineers, in New York City, Tuesday evening, April 15, 1884.

Mr. N. S. Keith called the meeting to order and nominated Mr. Jos. P. Davis, vice-president of the Metropolitan Tel. and Tel. Co., as chairman of the meeting. After Mr. Davis took the chair, Mr. Keith was elected temporary secretary.

Mr. T. H. Delano offered a series of resolutions as to name, objects, memberships, dues, management, committees, etc. On motion of Mr. Wm. A. Hovey, after some debate, the resolutions and the whole scheme of organization were referred to a committee of five, to be appointed by the chair, with instructions to call a meeting to hear and act upon its report. The chair afterward appointed the committee, consisting of the following-named gentlemen:

W. A. Hovey, Pres. Merchants' Elec. Light Co., Boston.
N. S. Keith, Electrical Engineer.
George A. Hamilton, Electrician W. U. Telegraph Co.
Wm. H. Eckert, Gen. Supt. Met. Tel. and Tel. Co.
Geo. L. Beetle, Western Electric Co.

After a vote of thanks to the American Society of Civil Engineers, and to Mr. John Bogart, the secretary of that society, for the use of its rooms, the meeting adjourned, subject to the call of the committee.

Applications for membership are to be addressed to N. S. Keith, Secretary, 237 Broadway, New York City.

The following additional names have been signed:

Frank C. Mason, Supt. Police Tel., Brooklyn.
W. D. Sargent, Gen. Man. Tel. Co., Brooklyn.
J. C. Reilly, Supt. Tel. Co., Brooklyn.
P. L. Watson, Supt. Fire Alarm, Brooklyn.
C. S. Thompson, Supt. A. D. T. Co., Brooklyn.
W. E. Huntington, Supt. Dist. Tel. Dept. B. & O. Co.
C. W. Price, Asst. Supt. Dist. Tel. Dept. B. & O. Co.
Thos. J. Nevins, Pres. United Tel. Co., Brooklyn.
W. A. Hovey, Pres. Merchants' E. L. & P. Co., Boston.
Frank B. Rae, Supt. Commercial Tel. Co.
Geo. Worthington, *Electrical Review*.
Charles L. Clarke, *Electrical Engineer*.
George L. Beetle, Western Electric Co.
T. C. Martin, THE ELECTRICAL WORLD.
F. B. Knight, Electrician.
H. B. Lytle, Electrician, Boston.
Geo. C. Maynard, Electrician, Washington.
Prof. Edwin J. Houston, Electrician, Thomson-Houston Co.
C. M. Lungren, Union Elec. Mfg. Co.

DEPARTMENT OF INQUIRIES.

44.—MAGNETISM FROM STATIC DISCHARGE.

(1) "If a continuous discharge of a Leyden jar or plate machine be passed through the coil of an electro-magnet, would the soft iron-core be magnetized? (2) If static discharges be passed through either helix of an induction coil, will the other helix show any signs of induced current?" T. D. B.
TAFTVILLE, CONN.

The discharge from any static source, whether continuous or momentary, through any conductor, is an electric current, but of very high tension, or electro-motive force, due to the great differences of potential. The strength of current is small, but its dynamic value is great, owing to the high electromotive force, after the equation: Dynamic value = C × E = Current × Electro-motive force.

The coils of the electro-magnet or of the inductorium must be made extremely long, so that the effects of a weak current may be multiplied many times, after the equation: Magnetism = Current × Convolutions.

By observing these conditions the effects inquired about may be obtained. K.

THE TELEGRAPH.

A ROYAL ELECTRICIAN.—Christian IX., of Denmark, knows more about hunting than modern inventions. He recently wanted a pair of boots sent him by telegraph.

THE COMMERCIAL CABLE.—The steamship Faraday cleared for Nova Scotia on April 16 from London. It carried the first installment of the Commercial cable to the amount of 1,100 miles.

CHEAP TELEGRAMS IN ENGLAND.—The Government has decided to postpone the contemplated reduction of telegraph rates from 1s. to 6d. per 20 words till some future time, which will be announced by the Right Hon. Hugh C. Childers, Chancellor of the Exchequer, in his budget speech.

A HOUSE IN WHICH MORSE LIVED.—It is interesting to note that the house on the Hudson, near Poughkeepsie, once occupied by the late Prof. S. F. B. Morse, is offered for sale. This house stands on a bluff overlooking the river, and is said to be one of the most desirable country seats along the Hudson.

A MERE BAGATELLE.—Speaking of recent interruptions of telegraphic communications between England and Scotland, Postmaster-General Fawcett stated, in the House of Commons, that the cost of substituting underground for overhead wires even between the principal cities would cost not less than $8,750,000.

MR. GOULD'S EASY FRAME OF MIND.—Mr. Gould stated last week: "I am going away soon. Western Union does not fear competition. It is attending to its own business, and is not buying any opposition lines. The pneumatic tubes are going to be a great benefit to the company. Messages can be sent by it from Twenty-third street to Dey street in two minutes. Arrangements at the Twenty-third street building are such that the company's office costs it nothing."

TROTTING OUT AN OLD IDEA.—A correspondent writes as follows: In the issue of April 12, page 123, I find "Kinks in Submarine Cables, etc." It is really amusing to note that the expedient adopted by Messrs. Trott & Hamilton is to make each alternate layer of sheathing cross each other. This method of placing the hempen bedding around a cable previous to its being armored with wires, was adopted by Mr. W. W. Marks, Superintendent of the Bishop Gutta Percha Works of New York city, in the year 1864.

THE CHARTER OF THE MUTUAL DISTRICT CO.—An application has been made to the Attorney-General for the commencement of an action to vacate the charter of the Mutual District Telegraph Company of New York, on the ground, among other things, that its capital stock was issued without consideration. A hearing on the application was had at Albany, N. Y., on the 17th, before the Attorney-General, and arguments were made by Charles W. West, of New York, on behalf of the applicant, and by Grosvenor P. Hubbard on behalf of the company. The decision of the Attorney-General was reserved.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—The Executive Committee, having consulted with many of the members, have decided to change the time and place of the Annual Meeting to Philadelphia, in September, 1884, in order that members may have an opportunity to visit the International Electrical Exhibition to be held there from September 2d to October 11th, under the auspices of the Franklin Institute. The exact day and place of the meeting will be announced as soon as the Committee can determine the most favorable date. It is hoped this action will meet with the approval of all interested.

THE TELEPHONE.

THE NEW ENGLAND COMPANY'S INCREASE.—The net increase of telephones by the New England Company in March was 186, making 17,826 instruments in use March 31.

ERIE INCREASE.—The southwestern division of the Erie Telephone Company increased its subscribers 165 in March, and has ordered 80 instruments on account of April. It is estimated that as many as 60 were added in the Northwest and Cleveland divisions, making a total increase for March of 225.

THE AMERICAN PORTABLE TELEPHONE CO.—A meeting of this Company was held at their office, 108 Temple Court, on the 16th inst. It was decided to put 10,000 shares of treasury stock on sale at $7.50 per share. Capt. Beecher made a report of progress in the further utilization of the apparatus, especially for fire department purposes.

THE DRAWBAUGH CLAIMS.—The last of the sur-rebuttal evidence in the Bell *vs.* Drawbaugh case has been given in at Harrisburg, Pa., during the last few days. It is not expected that the case will come to trial in June or July. The Drawbaugh representatives consider that the last evidence materially strengthens their testimony already obtained and makes them impregnable.

AN "ANTI-BELL" TELEPHONE.—The Boston *Herald* says: A new short distance telephone has entered the field—the "Anti-Bell"—whose chief merit appears to consist in its phosphor-copper-bronze wire. It disclaims infringing American Bell patents, but maps out its own destiny as a "formidable rival" to that telephone and the system of exchanges generally. It at least has this virtue—that it offers telephones and not shares to the public.

THE NEW ENGLAND CO.'S QUARTERS IN BOSTON.—The change of location of the central office is necessitated, says the Boston *Herald*, by the growth of business, as the company is about to introduce the multiple switch-board, which will increase the capacity of the Pearl street office to 4,200 subscribers, exclusive of 1,500 in other parts of the city. The costs of operation will be reduced about 25 per cent. by this change. The expense of the change is not stated.

ALTON, ILL.—The last telephone directory to hand is that of the Alton, Ill., exchange, working under the Central Union Telephone Company, third district. It now has nearly 150 subscribers and about 40 outside connections. Mr. S. H. Brakel is the manager. We note that books of coupon tickets for toll line service are offered at a 10 per cent. discount on all sales up to $20, 15 on from $25 to $45, and 20 on sales from $50 up. The directory is tastefully printed, and contains numerous local "ads."

SPRINGFIELD, ILL., TELEPHONIC ITEMS.—Mr. J. L. Himes, of Lewistown, Penn., has been appointed city inspector, vice Howard Hillman, resigned. Mr. Homer Bishop, of Bloomington, Ill., will be his assistant. A new switch-board, with numbers 350 to 600, has been placed in position. New subscribers are coming in at the rate of about one each day, and there seems to be no limit to the increase. Springfield is now far ahead of anything in the State, outside of Chicago. A new list was to be issued about April 10th, including every subscriber to that date. The toll-room is liberally used by the public now, and conversation is readily carried on to points within 100 miles.

MORE TELEPHONE SUITS.—A Pittsburgh paper of late date says: The attorneys of the Bell Telephone Company are in this city now preparing to enter a suit against the United States Telegraph and Secret Telephone Company. These attorneys are from Philadelphia. The Bell Company claims the exclusive right to operate all telephones in this section of the State, and will seek to have the new company restrained from operating here on that ground. The new company anticipated this suit, and is prepared to answer and push the case, they being anxious to have the question of the legality of the monopoly settled. The case will be commenced shortly in the United States Circuit Court.

THE "OVERLAND" COMPANY FOR NEW YORK.—The corporators of the Manhattan Overland Telephone and Telegraph Company, whose certificate of incorporation was filed in the New York County Clerk's office on the 15th inst., are Robert D. Buchanan, Allen T. Nye, William D. Leonard, Charles Henry Sibbald, Harvey N. Loomis, Hutchinson Ingham and William T. P. Hollingsworth. The business of the company is mainly to be done in the counties of New York, Kings and Westchester. Its capital stock is $2,000,000, divided into 200,000 shares, but this may be increased to $5,000,000. The shares of the company are held as follows: Messrs. Ingham and Hollingsworth, jointly, 199,995, and each of the other corporators 1.

THE ELECTRIC LIGHT.

PORTLAND, ME.—Mr. Jared Crane has severed his connection with the American Electric Light Co. He is a good electrician and telegrapher and will probably return to the telegraphic business, in which he was for many years known as one of the most skillful operators in the country.

DISCRIMINATION AGAINST THE ELECTRIC LIGHT.—A dispute occurred this week at Trenton, N. J., in the New Jersey Legislature, over the inequality of the tax imposed on gas and electric light companies. The bill seemed to make a discrimination against electric light companies by imposing a heavier tax on them than on gas companies. The Conference Committee of the two houses agreed to impose an equal tax of one-half of 1 per cent. on gross receipts and 5 per cent. on dividends over 4 per cent. in the cases of both classes of companies, and in that shape the act was put through both houses.

MISCELLANEOUS NOTES.

"OHM" AS A MEASURE OF WINE.—Electricians have looked upon the "ohm" as exclusively an electrical unit of measurement, but it would seem that the "ohm" is not new. The English literary journal, *The Saturday Review*, says: "A thousand louis d'or, or £960 for a fudder of 12 ohms of 10-year-old Johannisberg—equal to about £5 a dozen—was a good price to pay on the spot in 1789; and it is recorded to have been actually paid by an Englishman." There is nothing new under the sun.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Thursday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, b 58, a 59; American Rapid, b 50, a 65; B. & M. Co., b 127⅝, a 127⅞; Commercial Telegram Company, a 70; Harlem District Telegraph Co., a 5.50; Bankers & Merchants' Telegraph Co. 1st. mtge bonds, a 85; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; Northern & Southern Tel. Co. 1st mtge bonds, b 79, a 81; Postal Telegraph (stock), b 7, a 7.50; Postal Telegraph bonds, 1st 6 per cent., b 57.50, a 57.75; Western Union, b 67⅜, a 67⅝.

President A. W. Dimock, of the Bankers and Merchants' Telegraph Company, in his report of its operations for the past year, says there have been earned and paid dividends amounting to 8 per cent. on the stock, which now amounts to $2,000,000. The bonds issued are $1,800,000. It has also accumulated a surplus of $304,637.54, which includes premiums received in subscriptions to stock. The mortgage bonds amount to $10,300,000, of which $7,000,000 is to be deposited in trust with the Farmers' Loan and Trust Company, to be withdrawn only as the lines of the company are extended, and at a rate not to exceed $75 per mile of wire of such extension.

A rumor floating about the Windsor on Thursday evening was that the Western Union Telegraph Co. was about to issue $20,000,000 of new bonds, $7,000,000 to take up outstanding bonds at their maturity, $10,000,000 to cover construction expenses, and $3,000,000 to remain in the treasury. This rumor Mr. Sage declared groundless.

TELEPHONE.—American Bell, b 155, a 156; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24.50, a 25; Continental, b 15; Dolbear, b 5, a 10; Erie, b 28, a 35; Globe, a 9.50; Hudson River, b 60, a 90; Inter-Continental, b. 95, a 1.25; Mexican, b 2.50, a 3.25; Mexican Central, a 3; Molecular, b 5.50, a 10; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, 50, a 80; Overland, b 8.50, a 17; People's, b 10, a 12; People's (N. E.), b 1.50; Shaw, b 20; Solenoid, a 95; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, a 2 7-16; West India Telegraph and Telephone, b 1.95, a 2.

The Boston *Advertiser*, of April 17, thus quotes the local market: In telephone stocks American Bell advanced ¼ to 155¾; New England declined ½ to 26½; Erie sold at 29½, ex-dividend; Mexican Telephone at 2 7-16.

Ten thousand shares of treasury stock of the American Portable Telephone Co. are for sale at $7.50 per share.

It is said that the Bell company is earning 5 per cent. this quarter, and will pay an extra dividend in July in preference to increasing its dividend rate.

ELECTRIC LIGHT.—American, a 2, b 4; Edison Illuminating, a 55, b 75; Edison Isolated, a 90; Edison, European, b 3, a 15; Excelsior, a 35; United States, a 95; United States Ill. Co., a 90; American Elec. & Ill. pref., a 9¾; American Elec. & Ill. com., a 4¾.

BUSINESS NOTICES.

SOCIETY PUBLICATIONS FOR SALE.—"C. F.," care of this office, has for sale a set of the publications of the English Society of Telegraph Engineers, from 1876 to 1881. They are worth having.

THE ELECTRO-MAGNETO PENHOLDER.—This penholder is made by W. A. Armstrong, 202 Broadway, New York. It is of ordinary size and handsome appearance. The heat of the hand acting on a thermo-electro-magneto combination in the barrel generates a current that operates mildly on the nerves and muscles of the hand. The effect is beneficial, preventing or curing penman's paralysis or cramp, with which telegraphers so often become unpleasantly acquainted. The penholder has received many strong testimonials.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 237 Broadway, New York.

PATENTS DATED APRIL 1, 1884.

Binding-Post for Electric Conductor; Albert George Goodbody, of Louisville, Ky..... 296,160

A post encircled by a helical spring, a cap fitting over the post and resting on the spring, and a hole at right angles to the axis of the post through both cap and post to receive the conducting wire. The upward pressure of the spring against the cap clips the wire. The cap is provided with a button of insulating material and a pin running in a groove in the post to prevent turning on or slipping off the post.

Clock-Synchronizing Apparatus; Gustavus G. Wagner, of Mount Vernon, N. Y..... 296,256

An indicator is set automatically whenever proper clock-hand is adjusted by the sychronizing devices, so as to show subsequently the period at which such act was performed, and whereby the apparatus is rendered inoperative, except at a certain predetermined period so that it is not liable to be affected by a current due to a disturbance in the line or the use of the line for other purposes.

Electrical Conductor and Connecting Device Therefor; John Kruesi, of Brooklyn, Assignor to the Electric Tube Company; of New York, N. Y..... 296,185

The insulated conductors are wound spirally, with a long pitch, with cords which serve when the conductors are placed in the tube to keep them at proper distances apart. The tubes are then filled with an asphaltic cement or like material. The junction pieces are metallic cables in short lengths, which bend readily to compensate for expansion and contraction of the conductors.

Electro-Magnetic Car-Brake; Harvey S. Park, of Henderson, Ky..... 296,211

A supplemental set of electro-magnets is provided for retaining the brakes in any desired position to which they have been set.

Electro-Magnetic Car-Brake; Harvey S. Park, of Henderson, Ky..... 296,212

A secondary battery is provided which operates the brake-magnets whenever the dynamo, which charges the battery or normally operates the brake-magnets, is inoperative.

Electric Switch-Board; Theodore N. Vail, of Boston, Mass..... 296,253

Consists in a switching apparatus composed of a series of sheets of non-conducting material superposed one upon another, the mass being perforated with as many holes as there are subscribers' lines. Interleaved with the insulating sheets are alternating series of conducting stripe, bars, or wires, the consecutive layers being transversely disposed with reference to the layer immediately adjacent upon either side. The several strips are so fixed that each one extends across an arc of the holes it crosses, thus forming a chord to the arc. Each hole, in virtue of the numerous chords it thus contains, is practically square. The several connecting plugs are made in pairs to reach through the mass and to connect the line-plate with any desired one or two of the connection strips; and, finally, all of the connection-strips upon the same horizontal plane are connected together, so as to constitute an individual electrical conductor separate from all others and complete in itself.

Electrotype and Stereotype Casting Pan; Calvert B. Cottrell, of Stonington, Conn..... 296,277

A method and apparatus therefor of backing curved electrotype plates by perfecting the form of the shell and holding it in position by pins inserted through perforators in a cover during the introduction of the molten metal.

Electrotype and Stereotype Casting Mold; Calvert B. Cottrell, of Stonington, Conn..... 296,278

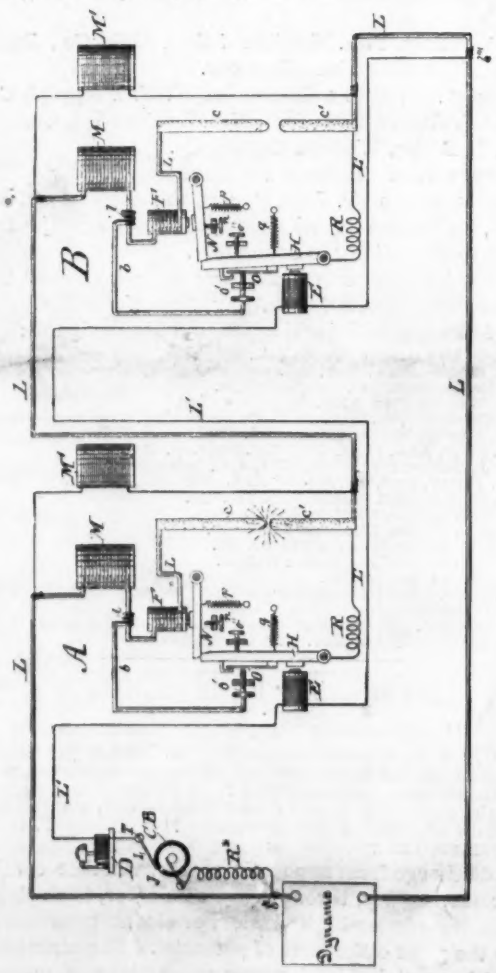
The cover of the mold is made up of sections which are provided with perforations adapted to receive pins which hold the shell in position during the introduction of molten metal.

Insulated Conductor; Theodore Miner, of Brooklyn, N. Y..... 296,294

One or more insulated conductors, a wooden insulator thereabout formed of grooved section, and an exterior metallic protection, inclosing and protecting the wooden insulation.

Automatic Cut-Out for Electric Lamps; Charles L. Buckingham and Henry C. Townsend, of New York, N. Y..... 296,125

Line *L* extends from a dynamo-machine or other generator, and, as shown, has two lamps, respectively situated at *A* and *B*. At point *l* line *L* is divided into two branches, one embracing the carbons, *c c*, of the lamps and coils of electro-magnet *F*, and the other branch forms a normally open shunt or by-path around the arc. The by-path has its circuit through wire *b*, stop O^1,



spring *O*, relay armature bar *H*, and resistance *R*. A points b^1 b^{111} an auxiliary wire L^1, much finer than *L*, is connected to L_1, and at a point near the dynamo a periodic circuit-closer rotates intermittently, and at each rotation brings metallic *J* in contact with contact-brush *T*. Line L_1 is provided with an artificial resistance, R^2, and at each lamp of the system includes the coils of an electro-magnet, *E*. Upon each rotation of *C B*, line L^1 is closed, and a short electrical impulse passes over the line. Each impulse upon line L^1 causes at each lamp armature-bar *H* to be attracted, thus bringing spring *O* into contact with anvil O^1. During the instant of closing the by-path, whose resistance is considerably greater than that of an arc of normal resistance, some current will be diverted from the arc-branch, providing the arc resistance be low; but if the carbons have burned away, so as to interpose a large resistance, a much greater part of current will be diverted from the arc branch through the by-path, thus leaving the current too weak to longer hold armature bar *N* against the force of its retracting spring *p*, and the lever *N* will be retracted against stop *u*. Armature bar *H* must take its movement as a condition precedent to the backward movement of *N*; but if *N* be released at all its end will drop behind *H* and lock *H* at or near its front position. By using spring *O*, which is in metallic connection with *H*, the lever *H* may have a slight backward movement toward O^1 under the influence of spring *q*, without breaking contact between *O* and O^1. After the lever *N* has locked *H* to form a contact in the by-path, the by-path will remain closed until the arc resistance shall have been removed, notwithstanding that the line L^1 may almost instantly be broken by the periodic circuit closer *C B*. At the removal of the resistance from the arc branch, however, armature lever *N* will be raised and the by-path broken, and again the entire current will flow through the arc branch.

Insulator for Electric Conductor; William Hope Davis, of Springfield, Illinois..... 296,146

Plates or blocks of any insulating material impervious to moisture are made of rectangular shape, and having V-shaped longitudinal grooves on their upper and under faces. A course of these is laid in a trench or other prepared place; the wires are laid in along the grooves, and another course is laid on top; then another lot of wires, *et seq.*, until the desired number of wires are laid, when a plate covers the whole, and all are cemented by a water-proof cement.

Magnetic Ore Separator; Felix Victorien Rouleau, of Isle Verte, Quebec, Can..... 296,068

The cylinder of the separator has its entire outer surface provided with radially-arranged electro-magnets, which have their polar extremities of rectangular form and arranged in close proximity to each other.

Manufacture of Compound Electric Wire; John J. Williamson, of Boston, Mass..... 295,966

This conductor consists of a steel central thread covered by iron as a tube, and the whole plated with copper.

Secondary Battery; Alfred Haid, of Rahway, Assignor to Haid's Electrical Storage Company, of Newark, N. J..... 296,164

An electrode composed of an assemblage of strands consisting of threads or cords of fibrous material, coated or covered with lead or its equivalent.

Telephone; Frank B. Cook and Frank F. Graves, of Toledo, O..... 296,983

A telephone receiving instrument provided with a cover in front of the diaphragm, adapted to receive and embrace the ear of the operator.

Telephone Signaling Apparatus; Walter J. Dudley, of Everett, Mass., Assignor to the Dudley Electric Manufacturing Co., of Concord, N. H..... 295,913

This apparatus belongs to that class of electrical signaling apparatus in which a series of electrical impulses operate switching devices step by step, the devices co-operating with a lever actuated by the supplemental armature. Devices for preserving unison are provided; also, devices for preventing any variation of line-resistance, while step-by-step devices are operative; also, devices for allowing a bell to be rung by ordinary alternating magneto-currents when circuited.

Telegraph or Other Poles; George F. Brott, of Washington, D. C..... 295,905

The poles are made of rough and cheap paper pulp mixed with tar, asphaltum or like materials, and pressed in molds of suitable shape. For high poles the base is made conical, but solid, and the superstructure is made with a recess in the lower end to fit over the upper part of the base. They may be made hollow, smaller at one end, and of different sizes, so as to be fitted one to the other, to build up a pole of any height.